Submitted to:
US EPA Region 8
Denver, CO

Submitted by:
Atlantic Richfield Company
May 23, 2013

Quality Assurance Project Plan For Surface Water and Groundwater

Rico-Argentine Mine Site – Rico Tunnels Operable Unit OU01 Rico, Colorado

Document Control No. 2013-R1-001A

Revision	Prepared By	Reviewed By	Approved By	Date	Pages Affected
0	AECI / AECOM			May 23, 2013	All

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Atlantic Richfield Company

Anthony R. Brown
Project Manager, Mining

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May 23, 2013

VIA EMAIL AND OVERNIGHT COURIER

Mr. Steven Way
On-Scene Coordinator
Emergency Response Program (8EPR-SA)
US EPA Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

Subject: Quality Assurance Project Plan (QAPP) Rico-Argentine Mine Site – Rico Tunnels Operable Unit OU01 Rico, Colorado

Dear Mr. Way,

A digital file in PDF format of the updated *Quality Assurance Project Plan (QAPP) – Rico Tunnels Operable Unit OU01 Rico, Colorado* dated May 23, 2013, is being submitted to you today via email. Three (3) hardcopies of the report will also be sent by overnight courier to your office.

Atlantic Richfield Company (AR) is submitting this updated QAPP responsive to requirements in Section 5.1 of the Removal Action Work Plan accompanying the Unilateral Administrative Order for Removal Action, Rico-Argentine Site, Dolores County, Colorado, U.S. EPA Region 8, Docket No. CERCLA-08-2011-0005.

If you have any questions or comments, please feel free to contact me at (714) 228-6770 or via email at Anthony.Brown@bp.com

Sincerely,

Anthony R. Brown

Anthony Brown
Project Manager
Atlantic Richfield Company

Enclosures (Quality Assurance Project Plan, Rico-Argentine Mine Site)

cc: Terry Moore, Atlantic Richfield
Sandy Riese, EnSci
Chris Sanchez, AECI
Dave McCarthy, Copper Environmental
Tom Kreutz, AECOM
Doug Yadon, AECOM
Mark Lombardi, AMEC
Spencer Archer, AMEC

Executive Summary

The Rico-Argentine Mine Site – Rico Tunnels Operable Unit, OU01, is located just north of the town of Rico, Dolores County, Colorado. Significant mining at the Site began in the early 1900s, and the most recent mining and mineral processing activities ceased in 1976-77. The Site consists of a complex of underground workings and an adit known as the St. Louis Tunnel that drains flows from the underground workings to a series of settling ponds which eventually discharge into the Dolores River. Atlantic Richfield Company (AR) retains responsibility for the Site and is currently operating under EPA Unilateral Administrative Order (UAO) for Removal Action, Rico-Argentine Mine Site, Dolores County, Colorado, U.S. EPA Region 8, Docket No. CERCLA-08-2011-0005, with an effective date of March, 23, 2011.

Under the UAO Remedial Action Work Plan (RAWP), monthly sampling is conducted at the Site to measure selected metals and non-metals concentrations at various points on the system, both in surface water and groundwater. In addition to metals and non-metals concentrations, field parameters (temperature, dissolved oxygen, and electro-conductivity) are measured for each sample, as well as flow rates and groundwater levels. Monthly sampling data are used to track concentrations of metals and other constituents discharged into the Dolores River, evaluate the effectiveness of the St. Louis settling ponds, and assess the possible effects of seasonal variations on the level of metals loading and pond performance.

This Quality Assurance Project Plan (QAPP) describes how AR will collect data to meet the objectives of the water quality sampling and flow and water level monitoring program and activities which occur at the Site. This program will be guided by a separate Sampling and Analysis Plans (SAP) which is a companion document to this QAPP. The SAP covers the monthly routine sampling program. This QAPP discusses how the sampling, analysis, and data management process will be controlled and monitored to ensure that the data are of sufficient quality, quantity, and completeness to meet the user requirements for the project.

Group A: Project Management

A1 Title and Approval Sheet

QUALITY ASSURANCE PROJECT PLAN FOR RICO SAMPLING AND ANALYSIS

This Quality Assurance Project Plan has been reviewed and approved by the applicable authority representing the project team. In addition, by signature below, we certify that all personnel working on the project have been trained to this plan:

Approvals

Project Name: Rico – Argentine Mine Site, Rico Tunnels, Operable Unit OU01
Location: Rico, Colorado
Document Title: Quality Assurance Project Plan

This plan was prepared through a joint effort of Anderson Engineering Company, Inc. (AECI) and AECOM Technical Services, Inc. (AECOM) on behalf of Atlantic Richfield. The preparer information is as follows:

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Steve Szocik
AECOM Quality Assurance Manager
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I have read and approved this QAPP with respect to quality elements, regulatory requirements, and Contract obligations and procedures.

Anthony Brown	Anthony R. Brown		5/30/13
AR Project Manager		Name/Signature	Date
Steve Szocik	Steve Szocik		5/30/13
Project QA Manager (or Designee dependent upon project requirements)		Name/Signature	Date

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ACRONYMS

AECI	Anderson Engineering Company, Inc.
AECOM	AECOM Technical Services, Inc.
AR	Atlantic Richfield Company
CDPHE	Colorado Department of Public Health and Environment
COC	Chain of Custody
CoW	Control of Work
DO	Dissolved Oxygen
DQO	Data Quality Objectives
DVM	Data Validation Manager
EDD	Electronic Data Deliverable
EPA	United States Environmental Protection Agency
HSO	Health, Safety, Security, and Environment Officer
HSSE	Health, Safety, Security, and Environment
ICB/CVB	Initial Calibration and Calibration Verification Blanks
LCS	Laboratory Control Samples
LPM	Laboratory Project Manager
LQAM	Laboratory Quality Assurance Manager
LQM	Laboratory Quality Manual
MDL	Method Detection Limits
MS	Matrix Spikes
MSD	Matrix Spike Duplicate
NPDES	National Pollutant Discharge Elimination System
ORP	Oxygen Reduction Potential
PARCC	Precision, Accuracy, and Bias, Representativeness, Comparability, and Completeness
PM	Project Manager
PQL	Practical Quantitation Limit
RPD	Relative Percent Difference
QA	Quality Assurance
QAP	Laboratory-Specific Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCM	Quality Control Manager
RAWP	Remedial Action Work Plan
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedures
SSHASP	Site-Specific Health and Safety Plan
STL	Sample Team Leader
TSEA	Task Specific Environmental Analysis
UAO	Unilateral Administrative Order
WQA	Water Quality Assessment

A3 Distribution List

The following project personnel have received copies of this document and will be provided with any subsequent revisions to this document:

Table A3-1: Distribution List

QAPP Recipients	Title	Organization	Phone	Fax	Email	Control No.
Stephen Way	EPA On-Scene Coordinator	EPA	303-886-1640	303-312-6071	way.steven@epa.gov	2013-R1-001
Tony Brown	Client Project Manager	AR	951-265-4277	801-972-6235	anthony.brown@bp.com	2013-R1-002
Chris Sanchez	AECI Project Manager	AECI	801-971-1767	801-972-6235	csanchez@andersoneng.com	2013-R1-003
Tom Kreutz	AECOM Project Manager	AECOM	303-228-3056	303-228-3001	thomas.kreutz@aecom.com	2013-R1-004
Doug Yadon	Certifying/Design Engineer	AECOM	303-542-4755	303-228-3001	douglas.yadon@aecom.com	2013-R1-005
Steve Szocik	QA Manager	AECOM	303-228-3069	303-228-3001	steve.szocik@aecom.com	2013-R1-006
Jeff Roehrig	QC Manager	AECI	720-684-9936	801-972-6235	jroehrig@andersoneng.com	2013-R1-007
Mark DeFriez	Sample Team Leader	AECI	801-234-9583	801-972-6235	mdefriez@andersoneng.com	2013-R1-008

The QA Manager, as listed herein, is ultimately responsible for updates and confirming distribution of any revisions to this plan. Electronic copies of any minor revisions will be sent to the document holders. Any major changes to the plan will be sent via hard copy. Each individual plan holder will be responsible for amending the plan books accordingly with the changes being sent.

A4 Project and Task Organization

A4.1 Introduction

The QAPP outlines the requirements for all project personnel to follow in regards to groundwater and surface water sampling and gauging, quality control, and quality assurance inspections, documentation, and testing activities. Oversight of the project will ensure that the final work product meets all project, contract, and regulatory requirements, as well as standard operating procedures (SOPs) and defined practices. Inspections and tests have been identified to confirm that the work product meets these goals, and to provide quantitative criteria of such.

The intent of the QAPP is to provide a process for collecting and managing data that will ensure its quality. This document discusses the data quality process prior to using the data to write reports or make presentations. The project team will use this QAPP as guidance for collecting, analyzing, managing, and validating data. This QAPP should be considered a companion document to the project Work Plans and Sampling and Analysis Plans (SAP).

The organizational structure, management control, functional responsibilities, levels of authority, lines of communication, and interfaces for activities affecting quality are identified and documented in this section. Activities affected by quality include, but are not limited to, training, inspecting, testing, operating, maintaining, repairing, modifying, computer usage and data management, verifying/validating, preparing and reviewing technical calculations, quality records processing, and data collection and analysis.

Figure A4-1 presents the key positions of project organization, including lines of communication. The responsibilities of the key individuals making up the project management, quality management, and field management teams are briefly highlighted below. These descriptions provide all parties a clear understanding of the role that each party plays.

A4.2 Project Management

EPA On-Scene Coordinator

The US Environmental Protection Agency (EPA) will be acting as the lead agency in the oversight of this project under the EPA UAO. The EPA On-Scene Coordinator will review draft submittals, receive final reports, and will provide direct communication, on behalf of the EPA, with Atlantic Richfield (AR) and the remainder of the project team.

Atlantic Richfield Company Project Manager

The AR Project Manager (PM) has ultimate responsibility for all project deliverables, and will interface with the EPA On-Scene Coordinator and consultant PMs concerning project deliverables and other issues pertaining to the project. Other responsibilities include:

- Ensuring that project deliverables are scheduled, budgeted, and prepared
- Ensuring adherence to the quality requirements of the UAO, specific work orders, quality management plans, QAPPs, and SAPs
- Serving as the primary point of contact with the EPA and regulatory agencies
- Communicating with the AECOM PM and AECI PM

AECOM Project Manager

The AECOM PM is responsible for designing the sampling program and plans in accordance with EPA, Colorado Department of Public Health and Environment (CDPHE), and Colorado Division of Reclamation and Mining Safety (CDRMS) and project requirements, reviewing field data, and reviewing final agency deliverables. AECOM will also provide quality assurance (QA) to the project. The PM is responsible for the quality of work performed by those individuals assigned to them. The PM is responsible for all operations associated with implementation of the QA organization, including, but not limited to:

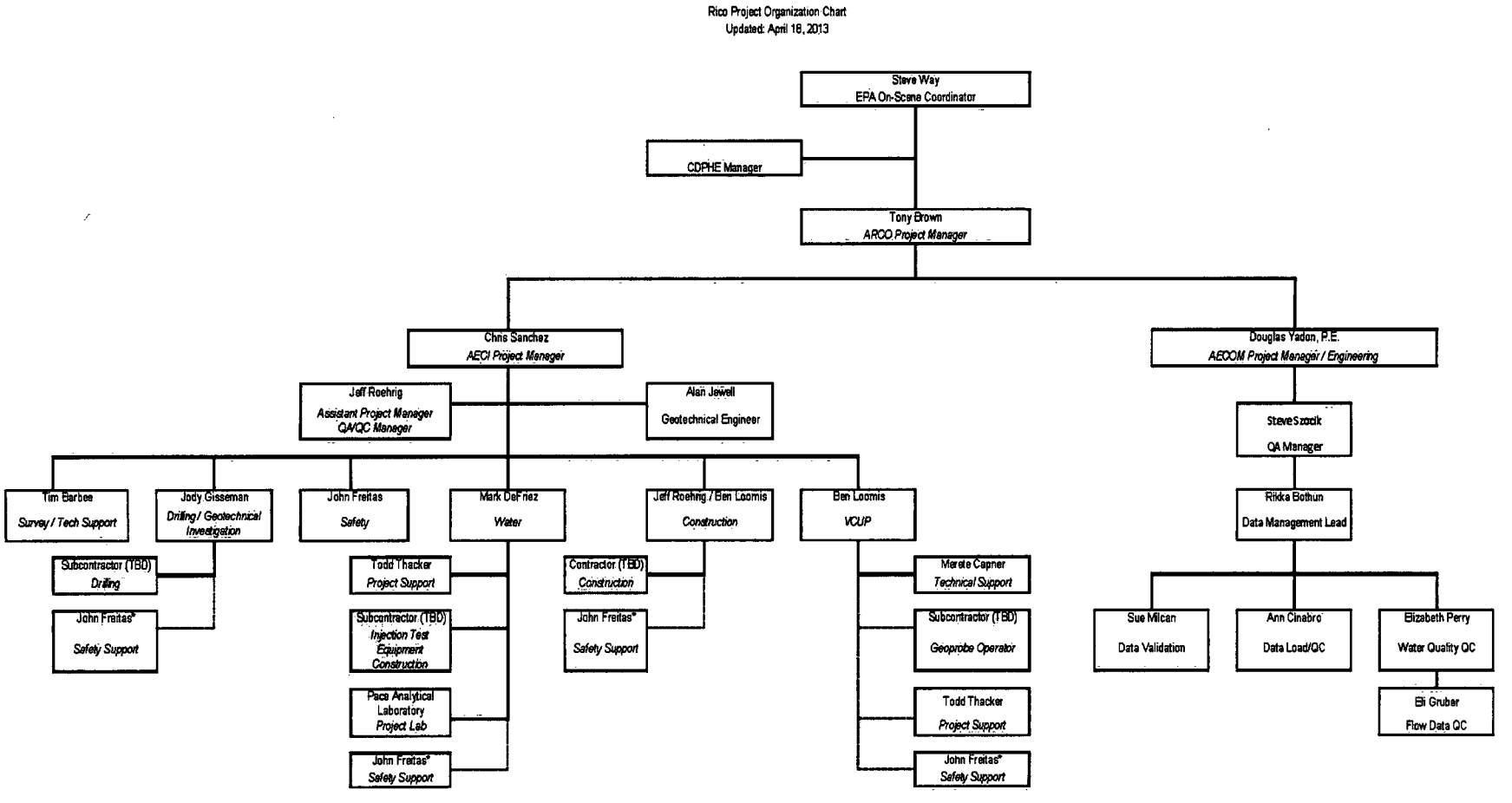
- Managing all aspects of project design and QA oversight and ensuring conformance with project plans and procedures
- Maintaining liaison between QA organization and field sampling organization (AECI)
- Acting as company point of contact with AR PM and AECI PM
- Directing and coordinating updates to AECOM budget and schedule
- Identifying and resolving project issues relating to design and QA functions, and resolving any identified deficiencies or non-conformances
- Identifying and providing resource needs to the project

Anderson Engineering (AECI) Project Manager

The AECI Project Manager is responsible for implementing the QAPP and other project sampling plans, conducting and reporting investigations, supplying technical support for field personnel, responding to any problems that may arise in the completion of the field tasks, and preparing the draft monthly report for agency delivery. In addition, the AECI Project Manager is also responsible for the following:

- Planning for safe execution of the project from design to completion
- Managing all aspects of project execution involving plan design, sample collection, handling, and processing
- Acting as primary point of contact between AR PM and AECOM PM
- Directing and coordinating updates to AECI budget and schedule
- Identifying and resolving project issues, including all identified deficient and nonconforming work items

Figure A4-1: Rico Project Organizational Chart



Notes
* Serves in a support function only, not reporting function

A4.3 Quality Assurance / Quality Control Responsibilities

Quality Assurance Manager (QAM), AECOM

The Quality Assurance Manager (QAM) has overall responsibility for the quality of project data and is not involved in any data generation. The QAM responsibilities are listed below. Additional roles (AECOM QA Supervisor, etc.) are not described in detail in this section, but are shown on the Rico Data Management Procedure and Timeline (Appendix A).

- Maintaining, updating, and distributing the QAPP to applicable project team members
- Coordinating with the AECI QC Manager (QCM) to ensure that appropriate procedures are followed in the field and during data entry/data review, and that QC steps are documented according to requirements in the SAP and QAPP
- Ensuring appropriate QC review is performed on data prior to incorporation into project database and distribution of monthly report, including:
  - Ensuring AECOM Data Manager and AECOM QC Reviewer complete appropriate steps to review the laboratory report, chain of custody forms (COCs), electronic data deliverables (EDDs), and monthly report tables for completeness and accuracy.
  - Ensuring AECOM Data Validation Manager completes validation review of the data and that validation qualifiers are incorporated into the database as appropriate.
  - Coordinating with the AECOM Water Quality QA Reviewer to ensure a geochemical review of the data is completed and any issues are communicated to the appropriate project team members.
  - Coordinating with AECOM Flow QA Reviewer to ensure that review of the hourly and instantaneous flow values is completed. Communicate any potential issues to the AECI QA Reviewer and AECI Sample Team Leader to ensure that any necessary corrective actions are taken.
  - Communicating to AECOM Data Distributor when all required QC reviews have been completed and data and monthly report are ready for delivery to the agency.
- Stopping work if deemed appropriate
- Providing clarification and guidance to project team personnel concerning QA matters
- Evaluating and ensuring the satisfactory performance of the QA personnel and verifying the corrective actions to be taken for significant conditions adverse to quality
- Maintaining programmatic quality records identified in procedures, work plans, or other documents as applicable

Quality Control Manager (QCM), AECI

The AECI Quality Control Manager, or designee, responsibilities include, but are not limited to, the following:

- Evaluating the quality of work performed by the field implementation team by conducting audits and quality reviews for compliance with requirements specified in the UAO
- Ensuring that any data transcribed from field forms to electronic format is thoroughly reviewed for accuracy before it is submitted for inclusion in the monthly report and project database
- Supervising project QC personnel; or, if no other personnel assigned, performing QC functions on the project. The responsibilities for QC personnel are as follows:
  - Conducting the required inspections and test activities as detailed in work plans, sampling plans, and quality plans
  - Ensuring that further processing, delivery, installation, and use of products or services are controlled in cases where unsatisfactory conditions are known
  - Identifying and reporting deficient and nonconforming items and reviewing the disposition of nonconforming items
  - Ensuring that field changes are implemented and documented according to governing standards, programs, procedures, etc.
  - Monitoring and assessing field activities to ensure the quality of work performed meets specified requirements
  - Preparing nonconformance reports if a characteristic, documentation, or procedure renders the quality of an items or activity unacceptable or indeterminate

- Preparing a field report detailing QC status of the project task or activity observed
- Reporting and communicating any deficient or nonconforming items to the Project and Task Managers, as well as applicable project personnel.
- Developing, implementing, reviewing, and updating project QC procedures
- Forecasting QC personnel staffing levels
- Providing input for the development of project-specific QC objectives
- Reviewing project scope of work, plans, and procedures for discrepancies and impact on the quality program and applicable quality documents, during development and prior to being implemented on the project
- Interfacing with Project and Task Managers on QC issues
- Interfacing with QA Manager regarding project QC issues
- Identifying QC requirements with the project design team
- Performing technical reviews of all prepared plans and reports
- Reviewing all project quality plans and documents

Laboratory Project Manager (LPM), Pace

The laboratory project manager (LPM) is independent from the daily Site operations. The LPM's responsibilities include:

- Coordinating laboratory analyses
- Supervising in-house COC
- Scheduling sample analyses within required holding times
- Overseeing data review and preparation of analytical reports and (Electronic Data Deliverable) EDD
- Approving final analytical reports and EDDs before submission

Laboratory QA Manager (LQAM), Pace

The laboratory QA manager (LQAM) is independent from the daily Site operations. The LQAM's responsibilities include:

- Overseeing laboratory data QA and administration of this QAPP
- Communicating data issues through the Laboratory Project Manager (LPM)
- Reviewing and approving laboratory QA/QC procedures
- Reviewing QA documentation
- Conducting compliance review of EDDs to hardcopy data results
- Developing and implementing laboratory corrective actions
- Defining appropriate laboratory QA/QC procedures
- Evaluating effectiveness of the project-specific quality program
- Reviewing and approving laboratory SOPs

Data Validation Manager (DVM), AECOM

The Data Validation Manager (DVM) is independent from the daily operations of the units generating analytical data. Responsibilities include:

- Communicating any lab issues to the LPM via the AECI Sample Team Leader (STL), as needed
- Scheduling and oversight of, or conducting, data validation; review and submittal of data validation reports in compliance with the QAPP directives
- Reviewing project data QA/QC issues when requested by the QA Manager
- Scheduling and oversight of, or conducting QC review of EDDs of laboratory chemical data, addition of any data validation qualifiers assigned, and import of EDDs to the project database
- Notifying the laboratory and QA Manager of specific laboratory non-conformances and changes as needed

A4.4 Field Responsibilities

The responsibilities of project field personnel are described in this section.

Health Safety, Security, and Environment (HSSE) Officer (HSO), AECI

The AECI Health, Safety, Security and Environmental (HSSE) Officer is responsible for the preparation, modification, and implementation of the Site-specific Health and Safety Plan (SSHASP). Any changes to the SSHASP must be approved by the HSSE. The HSSE is the designated regulatory contact on matters related to occupational health and safety.

Sample Team Leader (STL), AECI

The Sample Team Leader will be responsible for ensuring that the SAP is followed. His or her responsibilities include, but are not limited to, the following:

- Ensuring all sample technicians follow the quality goals set forth in the QAPP, SAP, and other sampling procedural documents
- Ensuring that all sample personnel execute the work safely, in accordance with all safety goals and requirements as outlined in the SSHASP
- Ensuring that an adequate number of sample technicians and field personnel with appropriate skills and training are scheduled for the sampling tasks
- Reporting any deficient or nonconforming work items as identified to the applicable Quality and Project Management staff
- Ensuring that all Control of Work (CoW) items are followed
- Confirming that all sample technicians and other field sampling personnel are properly trained and have the necessary supplies and support to safely execute and perform the assigned tasks
- Communicating with LPM as needed

A4.5 Lines of Communication

The general lines of communication are presented in the Project Organization Chart in Figure A4-1 above.

A5 Problem Definition and Background

A5.1 Problem Definition

Monthly sampling is conducted at the Site as described in the SAP (AECI, 2013) and summarized in Section A6.1. The objective of monthly sampling is to assess the current water quality at and in the proximity of the Rico-Argentine Mine Site (Site) to: a) update the current Water Quality Assessment (WQA, "Water Quality Assessment Mainstem of the Dolores River St. Louis Tunnel Discharge", Oct. 2008), if necessary, and b) establish receiving water quality to support the preparation of a discharge permit application and associated permit limits, evaluation of this data over an annual cycle, including seasonal low-flow periods. The sampling program also provides discharge water quality data to support system design and implementation of an effective water treatment system for the St. Louis Tunnel discharge including hydraulic controls.

A5.2 Site Description

The Rico-Argentine Mine Site is defined in the UAO as the complex of tunnels and other facilities at the Rico-Argentine Mine, including the Rico Tunnels Operable Unit, OU01, located just north of the Town of Rico, Dolores County, Colorado. The Rico Tunnels Operable Unit, OU01, is defined in the UAO as the portion of the Site consisting of an adit known as the St. Louis Tunnel, and a series of settling ponds located down-gradient of the St. Louis Tunnel which eventually discharges into the Dolores River. The Site is located approximately 0.75 mile north of the northern boundary of the Town of Rico in Dolores County. This location is in the SW¼ of Section 24 and the NW¼ and SW¼ of Section 25, T40N, R11W, within the USGS

Rico 7.5-minute Topographic Quadrangle.

A5.3 Site History and Background

A series of significant mining operations have taken place at the Rico-Argentine Mine Site since the early 1900s. The most recent mining activities ceased in 1976-77, while the Site was owned by the Rico-Argentine Mining Company. In 1980, the Anaconda Company (Anaconda) acquired Rico-Argentine Mining Company's surface and mineral properties in the Rico area. As part of the acquisition of Rico-Argentine Mining Company's surface and mineral properties in 1980, a pre-existing National Pollution Discharge Elimination System (NPDES) discharge permit (No. CO-0029793) was transferred to Anaconda. In 1983, water from the Blaine Mine on Silver Creek (outfall 002 under the original NPDES permit) was redirected to the St. Louis Tunnel and the Blaine Tunnel (or adit) became zero discharge. In 1984, Anaconda began operation of a new slaked-lime addition plant to treat mine water discharge from the St. Louis Tunnel as it entered the ponds system. Between 1984 and 1995, slaked lime was added to the tunnel discharge to improve water treatment and solids removal.

AR, a successor to Anaconda, sold its Rico properties to Rico Development Corporation in May 1988. The existing NPDES permit transferred to Rico Development Corporation at that time. Rico Development Corporation then sold/optioned its property holdings and the NPDES permit to others in April 1994. While owned by Rico Development Corporation, it is believed that borrow excavation over the portal area of the St. Louis Tunnel in approximately 1996 resulted in local collapse of the tunnel roof and walls. Around this time, use of the slaked lime system was discontinued and mechanical components were removed (the plant building is still present at the Site). The NPDES permit expired in 1999. In 2001, AR collected the dispersed surface flows from the tunnel portal collapse area into a common channel, diverted the flow through a Parshall flume, and rerouted the flow to Pond 18.

A5.4 Regulatory Program

A UAO for Removal Action was issued by EPA Region 8, Docket No. CERCLA-08-2011-0005, with an effective date of March, 23, 2011, for the Rico-Argentine Mine Site. Item 32 in the UAO requires implementation of the Removal Action Work Plan (RAWP) issued by the EPA February 25, 2011. Task A in the Work Plan discusses ongoing monthly surface and groundwater sampling and is related to both objectives stated in the Work Plan:

- Reduce the releases of hazardous substances from the St. Louis Tunnel Adit (also referred to in this Work Plan as "adit") and settling ponds into the Dolores River
- Manage the discharge from the St. Louis Tunnel Adit to control and reduce the flow and/or reduce the metals concentrations to levels deemed protective of water quality and aquatic life in the Dolores River

In addition, a WQA issued by the Colorado Department of Public Health and Environment (CDPHE) in 2008, as updated at some point, is expected to be the basis for the water quality discharge permit for the water treatment system (CDPHE, 2008). AR provided input on the preliminary draft, followed by several years of additional watershed sampling, laboratory analysis, and data evaluation that were incorporated into the 2008 WQA. The additional water quality and flow data that is being collected will be utilized in updating the WQA and eventual development of discharge permit limits.

The UAO cites the existence of cadmium, copper, lead, silver, and zinc in the discharge from the adit and in the sediment of the settling ponds as the reason for the Site being considered an actual or potential hazard to human and animal populations and a potential contaminant to drinking water sources. All analytes and laboratory reporting limits for the monitoring program are presented in Table A5.4-1.

Table A5.4-1: Sampling and Analytical Protocol Information

Analyte	Method	MDL	PQL/RL	Container Type	Chemical Preservation	Temperature Preservation	Holding Time
Field Parameters							
Dissolved Oxygen	SM 4500-OG	+/- 1.5% of reading	+/- 1.5% of reading	No Specified Container; Analyzed in Field	None	None	Analyzed Immediately after Collection in Field
pH	EPA 120.1	+/- 0.02 pH units	+/- 0.02 pH units				
Temperature (°C)	Standard Method 2550	+/- 0.15°C	+/- 0.15°C				
ORP (Oxidation-Reduction Potential)	Ag/AgCl Probe	+/- 1.0 mV	+/- 1.0 mV				
Electrical Conductivity (µmhos/cm)	EPA 120.1	+/- 1% of reading	+/- 1% of reading				
General Parameters							
Alkalinity (mg/L as CaCO3)	SM 2320B	1.2 mg/L	20 mg/L	500 mL HDPE Bottle	None	0 - 4 °C	14 days
Chloride	EPA 300.0	0.056 mg/L	1.0 mg/L	500 mL HDPE Bottle	None		28 days
Cyanide	EPA 335.4	0.005 mg/L	0.005 mg/L	250 mL HDPE Bottle	NaOH		14 days
Hardness	SM 2340 B	0.5 mg/L	0.5 mg/L	250 mL HDPE Bottle	HNO_3		6 months
Nitrate	EPA 353.2	0.022 mg/L	0.1 mg/L	250 mL Amber Glass Bottle	H_2SO_4		28 days
Salinity	SM 2510B (calculated)	None (calculated)	6 mg/L	250 mL HDPE Bottle	None		28 days
Silica	EPA 200.8	0.027 mg/L	0.054 mg/L	250 mL HDPE Bottle	HNO_3		6 months
Sulfate (mg/l as SO4)	EPA 300.0	1 mg/L	1 mg/L	250 mL HDPE Bottle	None		28 days
Sulfide	4500-S-2 D	0.018 mg/L	0.05 mg/L	250 mL HDPE Bottle	NaOH and Zn Acetate		7 days
Total Dissolved Solids (TDS)	SM 2540C	5.0 mg/L	5.0 mg/L	500 mL HDPE Bottle	None		7 days
Total Organic Carbon (TOC)	SM 5310C	0.072 mg/L	0.5 mg/L	250 mL Amber Glass Bottle	H_2SO_4		28 days
Total Suspended Solids (TSS)	SM 2540D	5.0 mg/L	5.0 mg/L	500 mL HDPE Bottle	None		7 days
Total and Dissolved Metals							
Aluminum (Al)	EPA 200.8	2.00 µg/L	4 µg/L	Two 250 ml HDPE Bottles(One Bottle for Total Metals; One Bottle, Field-Filtered, for Dissolved Metals)	HNO_3	0 - 4 °C	Mercury: 28 days All Others: 6 months
Antimony (Sb)	EPA 200.8	0.100 µg/L	0.5 µg/L				
Arsenic (As)	EPA 200.8	0.138 µg/L	0.5 µg/L				
Barium (Ba)	EPA 200.8	0.150 µg/L	0.3 µg/L				
Beryllium (Be)	EPA 200.8	0.092 µg/L	0.2 µg/L				
Cadmium (Cd)	EPA 200.8	0.028 µg/L	0.08 µg/L				
Calcium (Ca)	EPA 200.8	10.000 µg/L	20 µg/L				
Chromium (Cr)	EPA 200.8	0.094 µg/L	0.5 ug/L				
Cobalt (Co)	EPA 200.8	0.250 µg/L	0.5 ug/L				
Copper (Cu)	EPA 200.8	0.184 µg/L	0.5 µg/L				
Iron (Fe)	EPA 200.8	10.00 µg/L	50 µg/L				
Lead (Pb)	EPA 200.8	0.018 µg/L	0.1 µg/L				

Analyte	Method	MDL	PQL/RL	Container Type	Chemical Preservation	Temperature Preservation	Holding Time
Magnesium (Mg)	EPA 200.8	2.31 µg/L	5 µg/L				
Manganese (Mn)	EPA 200.8	0.250 µg/L	0.5 µg/L				
Mercury (Hg)	EPA 245.1	0.1 µg/L	0.2 µg/L				
Molybdenum (Mo)	EPA 200.8	0.069 µg/L	0.5 ug/L				
Nickel (Ni)	EPA 200.8	0.151 µg/L	0.5 ug/L				
Potassium (K)	EPA 200.8	5.24 µg/L	20 µg/L				
Selenium (Se)	EPA 200.8	0.094 µg/L	0.5 ug/L				
Silver (Ag)	EPA 200.8	0.040 µg/L	0.5 ug/L				
Sodium (Na)	EPA 200.8	10.40 µg/L	50 µg/L				
Thallium (Tl)	EPA 200.8	0.019 mg/L	0.1 µg/L				
Vanadium (V)	EPA 200.8	0.037 mg/L	0.1 µg/L				
Zinc (Zn)	EPA 200.8	1.00 µg/L	5 µg/L				
Potentially Dissolved Metals							
Aluminum (Al)	EPA 200.8	6.35 µg/L	50 µg/L	250 ml HDPE Bottle	HNO_3	0 - 4 °C	Mercury: 28 days All Others: 6 months
Antimony (Sb)	EPA 200.8	0.03 µg/L	1 µg/L				
Arsenic (As)	EPA 200.8	0.05 µg/L	1 µg/L				
Barium (Ba)	EPA 200.8	0.08 µg/L	1 µg/L				
Beryllium (Be)	EPA 200.8	0.05 µg/L	0.5 µg/L				
Cadmium (Cd)	EPA 200.8	0.05 µg/L	0.5 µg/L				
Calcium (Ca)	EPA 200.7	10.35 µg/L	100 µg/L				
Chromium (Cr)	EPA 200.8	0.07 µg/L	1 µg/L				
Cobalt (Co)	EPA 200.8	0.08 µg/L	1 µg/L				
Copper (Cu)	EPA 200.8	0.12 µg/L	1 µg/L				
Iron (Fe)	EPA 200.8	2.95 µg/L	50 µg/L				
Lead (Pb)	EPA 200.8	0.03 µg/L	1 µg/L				
Magnesium (Mg)	EPA 200.7	6.48 µg/L	50 µg/L				
Manganese (Mn)	EPA 200.8	0.250 µg/L	1 µg/L				
Mercury (Hg)	EPA 245.1	0.053 µg/L	1 µg/L				
Molybdenum (Mo)	EPA 200.8	0.12 µg/L	1 µg/L				
Nickel (Ni)	EPA 200.8	0.07 µg/L	1 µg/L				
Potassium (K)	EPA 200.7	44.38 µg/L	500 µg/L				
Selenium (Se)	EPA 200.8	0.14 µg/L	1 µg/L				
Silver (Ag)	EPA 200.8	0.01 µg/L	0.5 ug/L				
Sodium (Na)	EPA 200.7	21.68 µg/L	500 µg/L				
Thallium (Tl)	EPA 200.8	0.02 µg/L	1 µg/L				
Vanadium (V)	EPA 200.8	0.11 µg/L	1 ug/L				
Zinc (Zn)	EPA 200.8	1.04 µg/L	10 µg/L				

MDL= Method Detection Limit; PQL = Practical Quantitation Limit; RL = Reporting Limit; HDPE = High Density Polyethylene

A6 Project/Task Description

A6.1 Routine Monthly Monitoring

Routine monthly monitoring began at the Site in December 2010. Surface water and groundwater monitoring is conducted at the Site on a monthly basis to monitor water quality and water flow conditions. Sampling locations are shown on Figures 1, 2, and 3 of the SAP.

Field parameters are measured for surface water and groundwater samples. Instantaneous flow rates are measured for surface water samples, and static water levels are measured for groundwater samples. Water samples are also analyzed at an analytical laboratory for metals (total, dissolved, and potentially dissolved fractions) and non-metal inorganic parameters, as shown in Table A5.4-1. In addition, pressure transducers are installed in Parshall flumes to continuously monitor flow at two locations. Additional details about the sampling program can be found in the SAP.

The Rico Data Management Procedure and Timeline included in Appendix A details project data collection and data management and gives the applicable timeline for each task.

A7 Quality Objectives and Criteria for Measurement Data

A7.1 Project Data Quality Objectives

Project data quality objectives (DQOs) are used to ensure that environmental data are scientifically valid, defensible, and have an appropriate level of quality given the intended use for the data. The DQOs for this Site are:

- Monitor water quality (with a focus on metals) and flow rates of facility discharge into the Dolores River and of the Dolores River upstream, downstream, and adjacent to the Site to characterize water quality and evaluate effectiveness of St. Louis treatment/settling ponds
- Monitor water quality and water levels in groundwater wells throughout and adjacent to the Site to characterize water movement through the Site
- Monitor conditions throughout the year to assess seasonal variations and possible effects on discharge of contaminants, effectiveness of treatment ponds, etc.
- Ensure that the data collected is of sufficient quantity, quality, and content to accomplish the purposes listed above for all COC

QA objectives for project tasks should, if appropriate, include qualitative guidelines. To obtain high-quality data for the project, this QAPP establishes DQOs and data performance criteria. DQOs reflect the overall degree of data quality or uncertainty that the decision-maker is willing to accept during decision-making.

Data performance criteria discussed in this section quantitatively indicates or measures the data quality objectives.

The quantitative criteria used to evaluate data quality are presented in Table A7.1-1.

Table A7.1-1: Sampling and Analytical Protocol Information

Parameter	Location	QC Program	Evaluation Criteria	QA/QC Goals
Precision	Field	Field Duplicate Pairs	Relative Percent Difference (RPD[1])	RPDs will be ± 30% or results will be +/- the Reporting Limit (RL).
Precision	Lab	Lab Duplicate (or Spiked Duplicate) Pairs	Relative Percent Difference (RPD[1])	RPDs will be ± 20% or results will be within +/- RL.
Accuracy	Field	Field Blanks	MDL, PQL	<MDL
		Equipment Blanks	MDL, PQL	<MDL
Accuracy	Lab	Initial Calibration and Calibration Verification Blanks (ICB/CVB)	MDL	<MDL (verified in case narrative)
		Initial Calibration and Continuing Calibration Verification	Percent Recovery	Within method constraints (verified in case narrative).
		Laboratory Control Sample (LCS)	LCS Percent Recovery[2]	Percent Recovery Limit for LCS is 80%-120% for metals; control-charted for general chemistry.
		Matrix Spike / Matrix Spike Duplicate (MS/MSD)	Percent Recovery[3] and RPD	Percent Recovery Limit for MS/MSD is 75%-125% for metals; control-charted for general chemistry. The RPD limit for MS/MSD is ± 20%.
Representativeness	Field	Sampling Methods Described in Site Investigation Plan	Were sampling methods adhered to?	All samples collected by described methods.
		Planned, Timely Sample Handling, Prep, and Analysis	Required Holding Times	All laboratory work performed within required holding times.
		Field/Equipment Blanks	MDL, PQL	Results ≤ MDL
Comparability	Office	Proposed Consistent Units of Measurement	Are comparable units used in evaluations?	100% of results reported in the same units.
Comparability	Lab	Proposed Analytical Methods	Were approved methods used?	100% use of approved methods.
Comparability	Field	Standardized Sampling Methods	Proposed sampling methods adhered to?	100% use of proposed (i.e., approved) methods.
		QC samples 10% Field Duplicates Field Blanks, 2 per sampling event Lab QA	Were the samples collected as proposed?	Samples were collected as proposed.
Completeness	Office	Validation to be performed	Percent valid data	90% valid data

A7.1.1 Choice of Decision Rules

The following paragraphs briefly describe DQOs for the project using the seven-step DQO process described in the USEPA document, "Guidance on Systematic Planning Using the Data Quality Objectives Process" (EPA QA/G-4) (USEPA, 2006b).

A7.1.2 Data Quality Objectives (DQO) Process

Step 1. State the Problem. The problem statement is provided above in Section A5.1.

Step 2. State the Decision. State and/or Federal regulatory decisions and orders imposed for this Site are discussed above in Section A5.4.

Step 3. Inputs to the Decision. The State and/or Federal regulatory requirements are discussed above in Section A5.4

Step 4. Define the Site Boundaries. Site boundaries are presented in Figure 1, 2, and 3 in the SAP.

Step 5. Decision Rules. AR shall monitor and maintain the facility to comply with applicable regulatory requirements. All analytes and laboratory reporting limits for the monitoring program are presented in Table A5.4-1. Table A7.1-1 presents QA criteria for the compliance sampling laboratory methods. These criteria will be used to determine if compliance monitoring results meet the data quality objectives listed above.

Step 6. Establish Decision Error Tolerance Levels. Laboratory analytical detection limits will be established that meet the objectives of the program. The proposed methodology, reporting limits, and QC samples are adequate to ensure that false positives or negatives will not affect the project. The laboratory documentation will be sufficient to identify any analytical anomalies or outliers. Limited data validation will be used to minimize errors occurring from laboratory data. Project-specific QA objectives are described below in Sections A7.2.1 and A7.2.2.

Step 7. Optimize the Design for Obtaining Data. Regulatory oversight agency staff will have an opportunity to review monthly monitoring reports, the work plan, SAP, QAPP, and other applicable project documents, allowing appropriate stakeholders an opportunity to evaluate methods for optimizing the design of the compliance monitoring program.

A7.2 DQO Discussion

A7.2.1 Project-Specific QA Objectives

Detection Limits

The Method Detection Limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. MDLs are based on analysis of pristine sample matrices. Operationally, MDLs are determined according to protocols given in USEPA 40CFR, Part 136, Appendix B. The analytical laboratory is required to determine MDLs, at least annually, for each parameter required for this program.

The Practical Quantitation Limit (PQL) is the MDL modified to accommodate environmental matrices. PQLs are used as the reporting limit for environmental samples, and are generally three to five times the value of the MDL. Required laboratory PQLs (i.e., reporting limits) are presented in Table A5.4-1.

Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid measurements. Overall data set completeness for analytical data will be evaluated during the data validation process. Completeness is defined by the equation below:

$$C\% = \frac{S}{R}(100\%)$$

Where:
C = completeness
S = number of valid analyses
R = number of requested analyses

The completeness goal is essentially the same for all data uses: that a sufficient amount of valid data is generated. It is important that critical samples are identified and plans made to achieve valid data from critical samples. The completeness goals established for both the field and laboratory components are 90 percent.

Decision Rule

The target analytes, analytical methods, and laboratory reporting limits for the Site work are presented in Table A5.4-1. Table A7.1-1 presents QA criteria for the laboratory methods. These criteria will be used to measure whether the objectives listed in Section A7.1 are met.

The analytical methods have all been selected such that the PQLs are lower than the applicable regulatory limit for each analyte.

Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic population, a process control, or an environmental condition. Appropriate sampling procedures are implemented so that the samples are representative of the environmental matrices from which they were obtained. The sampling procedures are described in detail in the SAP and have been designed to ensure an appropriate level of representativeness in the data.

Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved using standard techniques to collect and analyze representative samples and the consistent reporting of analytical results in appropriate units. Comparability is limited by other parameters because the data sets can only be compared with confidence when precision and accuracy are known. For comparability, reporting limits for aqueous sample analyses must achieve the PQL for those samples not subject to dilution or affected by sample matrix. Comparability will be assessed as part of the water quality review conducted each month.

A7.2.2 Analytical QA Objectives

The data from field samples collected will include laboratory analyses of surface and ground water samples. As part of the QA/QC process, data quality indicators including precision, accuracy and bias, representativeness, comparability, and completeness (PARCC) will be evaluated for both laboratory and field quality control samples. Refer to Table A7-2 for defined control limits applicable to this project.

Precision

Precision is a measure of the mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. The overall precision of measurement data is a mixture of sampling and analytical factors. Precision is evaluated through field and laboratory duplicate samples. Overall data set precision for analytical data will be evaluated during the data validation process. The precision of analytical data can be evaluated by calculating the relative percent difference (RPD) between duplicate samples. The RPD is calculated using the equation below:

$$RPD = \frac{|C_1 - C_2|}{0.5*(C_1 + C_2)} * 100$$

Where:
C_1 = the first sample value and
C_2 = the duplicate sample value

Laboratory precision will be evaluated through analysis of laboratory duplicates, laboratory control sample duplicates (LCSDs), and/or matrix spike duplicates (MSDs). Laboratory precision should be determined by matrix for each QC batch or for every 20 samples (5 percent), unless an increased frequency is stipulated in laboratory SOPs for individual methods. In general, RPDs of less than 20 percent for laboratory duplicate samples of an aqueous matrix indicate the data are of high precision.

Sampling precision for this program will be evaluated by analysis of field duplicate (DUP) samples from a given location. Field duplicate samples will be collected for analysis at a rate of one sample in 10 (10 percent), or at a minimum of one per sampling event. Field duplicate samples will be analyzed for the same list of analytical parameters as the primary sample. In general, RPDs of less than 30 percent for field duplicate samples of an aqueous matrix indicate the data are of high precision.

Overall data set precision for analytical data will be evaluated during the data validation process.

Accuracy

Accuracy quantifies the degree of agreement of a measurement with a reference or true value. The accuracy can be evaluated by calculating the percent recovery (%R) of spiked samples.

The %R is calculated using the equation below:

$$\%R = \frac{(C_1 - C_0)}{C_2} \times 100$$

Where:
C_1 = the observed concentration of the spiked sample
C_0 = the concentration of the unspiked sample
C_2 = the theoretical concentration of the spiked sample

Laboratory accuracy for analytical methods will be assessed by spiking samples with known standards and measuring the percent recovery of the spiked analyte. Percent recoveries indicate the actual performance of the analytical method on real world samples. Known standards include matrix spikes (MSs) and laboratory control samples (LCSs). Matrix spikes and LCSs will be submitted for each QC batch or for every 20 samples (5 percent). Control limits for accuracy measurements are listed in Table A7.1-1.

Sampling accuracy will also be assessed by evaluating the results of equipment blanks and field blanks. Samples collected for analysis will be collected in disposable containers. Samples will be accompanied by an equipment blank if decontamination of reusable sampling equipment is practiced (i.e., using a pump to collect filtered samples). Equipment blanks check the adequacy of the decontamination procedures used at the Site. These samples would receive identification numbers similar to actual samples and will be submitted as normal field samples. Blanks will consist of distilled water poured over, or run through, the sampling equipment and collected in a clean sample container, after the equipment has been decontaminated. One equipment blank would be prepared and submitted for the same suite of requested analyses as are applicable for the other samples for each sampling event.

Field blank samples are collected in the field by running distilled water through the same sampling procedure used for all other samples. Field blanks serve to check the following of proper sampling procedures in the field to find out if contamination is being introduced as a result of the procedure. One field blank is collected for each sampling event.

Overall data set accuracy for analytical data will be evaluated during the data validation process.

A8 Special Training Requirements and Certifications

It is the responsibility of each employer to provide their employees with the required training (e.g., 40-hour OSHA training) and medical monitoring before assigning them to work at the Site. Site-specific training requirements are presented in the Site-Specific Health and Safety Plan (SSHASP). Each employer will provide documentation of current 40-hour OSHA training, medical monitoring, and fit testing to the HSEE Officer before sending their employees to the Site to work. Additionally, personnel will sign the Training Certification Sign-off Sheet (provided as Appendix B) to acknowledge the requirements of this QAPP prior to Site work.

A8.1 Personnel Training

All Contractors are responsible for providing qualified personnel to perform Site work to ensure compliance with the technical documents. Each individual following requisite training is responsible for the quality of his/her work.

Personnel performing field work will be required to be appropriately trained according to 29 CFR 1910.120. Field personnel will also receive a project-specific review based on anticipated Site responsibilities.

Field sampling and oversight personnel will be trained to the following documents:

- All applicable SOPs
- QAPP
- SAP
- Task Safety Environmental Analysis Risk Assessment (TSEA)

This training will be performed upon start of service by Contractor and personnel. They will be required to be re-trained on an annual basis to the above listed plans and procedures.

A person experienced with field sampling will be assigned to mentor each project person assigned to a field sampling task. The mentor will work with each person until the mentor feels their experience is adequate enough to perform sampling tasks on their own, without direct supervision. At that time, the sample person will complete their in-field training and the mentor will verify their experience, by signing the training form, provided as Appendix B.

An annual update review of all training will be required at the start of each sampling year and with each plan update, with updates to include review of procedures, plan changes, SOPs, and SAPs. The annual update will not require mentor training, only classroom and documented review of the project plans and documents. All training records will be maintained at the project Site for the annual period to which it pertains. All training records will be permanently kept with AECI at their corporate offices in Salt Lake City, Utah, with electronic copies provided to AR as part of annual project closeout.

The QAPP Training Certification Sign-Off Sheet is located in Appendix B.

A9 Documentation and Records

Project documents will consist primarily of the following: correspondence, deliverables or reports, records (i.e., information used to build documents), and QA/QC documents.

A9.1 Field Documentation Requirements

The following documents will be generated in completion of all field sampling/measuring/recording actions:

- Field Logbook
- Field Water Sampling Form
- Chain of Custody (COC) Forms
- Calibration Data Sheet
- Daily Field Report

All field documentation generated should follow basic document etiquette, which includes the following techniques:

- All handwritten forms should be legible, correct, and complete.
- Complete handwritten forms using blue or black ink, or indelible marker.
- Write clearly; print if necessary.
- Do not use a highlighter to emphasize important text; underline such text.
- Ensure all forms/records are complete. Do not leave blank spaces; if a section is not applicable, identify it as N/A. All forms or records should be signed and dated.

Corrections/amendments to document information or handwritten entries shall be made as follows:

- Draw one line through the item to be corrected; do NOT use correction fluid/tape.
- Write the correction adjacent to the item.
- Initial and date the correction/amendment next to the correction.

A9.1.1 Field Documentation Reports and Submittals

The QC and sample technicians will perform applicable inspections as follows:

- Conducting required inspections and records as defined in the Rico Data Management Procedure and Timeline (Appendix A)
- Documenting inspections and test records as defined by applicable SOPs
- Providing internal input to improve quality of work performed (e.g., Field Action Items and Quality Observations)
- Informing project team of all items that, if left uncorrected, would adversely affect the quality of the project
- Stopping work that does not meet quality requirements in project plans, specifications, and contract documents
- Preparing daily reports that identify QA/QC requirements
- Performing routine QC checks of work activities

The following quality inspection and test records will include the following:

- **Daily Field Report** – Detailing QC activities performed for a particular monitoring/sampling activity
- **Field Water Sampling Form** – Depicting monitoring and sampling identification and results for each sampling location
- **Chain of Custody Record** – Documenting custody procedures for each set of samples collected
- **Applicable Field Notes and Photographs** – Depicting each sample or monitoring location

Field Documentation Records Management and Retention

All data, reports, and related products generated during field collection of data will be stored in project files maintained by AECI at the project Site. These files will be transferred to AR at the completion of each sampling year. AR will store project data at the Atlantic Richfield office in Butte, Montana. The files will also include original laboratory reports and relevant historical information which has contributed to project decision-making. Readily available public information used during the course of the project may not be included in the project files. An extra set of field data, reports, and related products generated during this project will also be stored on CD media and on backup computer servers at AECI's office in Salt Lake City, Utah.

A9.2 Analytical Laboratory Documentation Requirements

The laboratory is entrusted to follow all internal quality control procedures (i.e., calibrations, performance checks) as directed in the analytical methods requested. The laboratory is also required to store complete data reports and raw data documentation as required by contract, State, or Federal protocols. Laboratory deliverables for the inorganic and general chemistry methods requested must include:

- Case narrative – include discussion of sample custody, sample condition, and analytical anomalies, and general assessment of internal laboratory QC (calibration, performance check) compliance
- Sample results – include method reference, MDLs, PQLs, units, dilution factors
- Method blank results – include MDLs, PQLs, units
- Laboratory Control Sample (LCS) recoveries
- Matrix Spike (MS) recoveries (reference source sample ID)
- Laboratory Duplicate or Laboratory/Matrix Spiked Duplicate (LCSD or MSD) results
- Laboratory control-charted or referenced QC limits for spikes, duplicates (%Rs, RPDs)
- Batch reference and dates of project and QC sample preparation and analysis, including dilutions
- Signed and dated COC records – include sample receipt temperature
- EQuIS format EDDs of project sample and QC sample results

The laboratory report and EQuIS format EDDs will be provided by the laboratory to AECI. AECI will review the laboratory report and EDDs for completeness. If either deliverable is incomplete, the laboratory will be asked to correct the problem and re-submit the deliverable. When the package is judged by AECI to be complete, the EQuIS-format EDD will be provided to AECOM for additional review and upload to the project EQuIS database. The laboratory report will be included as an attachment to the monthly report that is posted on the project SharePoint site.

A9.3 Analytical Data Validation Reports

The DVM will review 100 percent of analytical data and provide limited validation of the data presented in the final reports submitted by the analytical laboratory. These reports will include:

- Identification of the laboratory reports and tabulated project samples being evaluated
- Overall data assessments of field and laboratory precision, accuracy, completeness, and laboratory method compliance
- Review of project sample data and field and analytical QC samples to method and QAPP requirements
- Tabulated summary of any qualified data results

A9.4 Reports to Management

Reports to management will include:

- Monthly Surface and Groundwater Data Summary Report (AECI, with review by AECOM)
- Completed Limited Data Validation Reports (AECOM)

A9.5 Document Control and Archival

All data, reports, and related products generated during this project will be stored in project files maintained at the AR office in La Palma, California. The files will also include original laboratory reports and relevant historical information which has contributed to project decision-making. Readily available public information used during the course of the project may not be included in the project files. An extra set of field data, reports, and related products generated during this project will also be stored on CD media and on backup computer servers at AECI's office in Salt Lake City, Utah.

Data will be electronically managed using the project EQuIS database. Data are transferred in spreadsheet format as required between AR, AECI, AECOM, and EPA using email or the project SharePoint site. After project closure, all data, files, and other materials to be permanently filed will be inventoried. The files will be maintained by AR in accordance with the requirements of the UAO.

The EQuIS database is maintained by AECOM and is backed up according to AECOM's database management protocols. Electronic backup of other related project documents generated by AECOM or AECI will be performed in accordance with the respective organization's information technology department's electronic file backup protocols.

A9.6 QAPP Updates and Distribution

The QAPP will be maintained and updated as needed by the QAM. When updated, the QAPP will be distributed to the list identified in Section A3. The QAPP will be distributed via email and will also be posted on the project SharePoint site. Hard copies of the document will not be distributed unless requested.

Group B: Data Generation and Acquisition

B1 Sampling Process Design

The sample process was defined during the scoping meeting and subsequent investigation phases of the project that were a result of the UAO. The process includes a multi-type approach to include surface water sites, groundwater wells, flow, and elevation measurements within the non-stagnant water sources and including flumes, rivers, and adits located within the property and as identified by the maps provided with the various SAPs. In addition, this plan will be used to implement quality for all soil and other sampling activities performed at the project. A SAP will be developed for each project and will include the specifics for each sampling program.

Analytical sampling will provide water quality data points, including trace metals and other compounds of concern, in order to evaluate various strategies for addressing the items identified in the UAO. Each project-specific SAP will detail the purpose for the analytical sampling and the process by which the sampling will be completed.

The information that is critical to the success of these sampling programs will also be defined in the specific SAPs for each sampling project. The information that will be collected for background or information only will also be identified (as noted, for example, on Table 2-1 of the Sampling and Analysis Plan for Surface and Groundwater Sampling).

Each SAP will also identify the various pitfalls and sources of variability based upon sample collection methods. Each sample collection method will further discuss how sources of variability will be reconciled and minimized on the project. This information is as presented, for example, in Section 6.0 of the Sampling and Analysis Plan for Surface and Groundwater Sampling.

Analytical sampling will provide water quality data points, including trace metals, in order to prepare and evaluate the Water Quality Assessment for the CDPHE. The purpose of the sampling program is to collect data designed to meet the DQOs defined in Section A7.

B2 Sampling Method Requirements

B2.1 Sampling Procedures and Requirements

All sample procedures and requirements are defined in the various Sample and Analysis Plans that have been prepared for the various sampling tasks associated with this project. Each SAP has associated Standard Operating Procedures that define the sample and analysis tasks. The SOPs are typically included as appendices to the SAPs which they support, and include the following:

Table B2.1-1: Water Sampling Activities Standard Operating Procedures

SOP No.	Revision	Date	Matrix	Description	Regulatory Citation	Modifications
1-6	0	2007	GW, SW	Sample Custody and Documentation	Method 1669	None
1-11	0	2007	GW, SW	Packaging and Shipment of Field Samples	Method 1669	None
2-9	0	2008	GW, SW	Field Water Quality Measurement	None	None
3-1	0	2001	SW	Surface Water and Sediment Sampling	Method 1669	None
3-4	0	2002	SW	Streamflow Measurement	Method 1669	None
3-7	0	2012	SW	Streamflow Measurement with Ice Present		None
3-8	0	2013	SW	Collection of Cross Channel Surface Water Samples	Method 1669	None
4-1	0	2007	GW	Groundwater Sampling	Method 1669	None
4-9	0	2008	GW	Well Purging	Method 1669	None
E1669	0	1996	GW	Sampling Ambient Water for Trace Metals	Method 1669	None

B2.2 Sample Collection Procedures

The sample collection process is as defined by AECI SOP No 3-1, 4-1, and 3-8. It is further guided by EPA Standard Procedure 1669. Both practices are included as Appendices in the SAP. All lead field personnel will be trained and certified as proficient on the applicable procedures prior to performing any field task, as indicated in Section A8 above.

B2.3 Sample Containers, Volume, and Preservation

The sample containers are provided by the analytical laboratory. They are ordered via a sample order form in advance of the sampling event. Upon receiving the order, the laboratory packages clean sample bottles (including the necessary preservative) and sends them to AECI Rico field office.

The applicable containers (volume, size, and quantity, with the necessary preservative for each analysis) are defined further in Table A5.4-1 above.

B2.4 Equipment/Sample Containers, Cleaning, and Decontamination

As defined by the SAP, all groundwater sampling is conducted using a dedicated bailer assigned to each well location. The collected water is then transferred to a clean disposable gallon jug and transferred to the lab building where the samples are placed into the analytical containers, logged, and packaged for shipment.

All surface water samples are collected directly into a clean, disposable plastic gallon jug.

All sample packaging and handling is delivered back to the lab building where samples are transferred to the sample containers, final water quality readings collected, and filtration of field-filtered metal samples.

B2.5 Corrective Actions

Corrective actions are discussed in section C1.3 in this QAPP.

All quality-related items that are identified during sample and field data collection will be reported using a Quality Observation Form. The observations can be identified by any project personnel and will be completed and reviewed at the start of the next project shift during the Daily Toolbox Meeting. The purpose of the Quality Observations is to assist the project with maintenance of the quality objectives.

The Quality Observation Forms will be recorded and, if necessary, tracked until a reported item is closed. It is assumed that most Quality Observations are minor in nature and can be resolved relatively easily at the time of their identification with the field personnel involved.

If a Quality Observation is found to be in violation of project requirements, or if an observation item is not addressed in a timely manner, causing a violation of project requirements, a non-conformance report will be generated detailing the violation and the proposed corrective action for resolution of the violation. All nonconformances will be tracked from the time at which they are issued until they are resolved to the satisfaction of the QAM and PM.

All items identified during field operations will be tracked until resolution and shared with all personnel on the project team.

B3 Sample Handling and Custody

COC procedures are intended to document sample possession from the time of collection to acceptance by the analytical laboratory.

B3.1 Sample Collection

Sample collection will be performed according to methods described in the SAP. Sample size, containers, and preservatives to be used are also described Table A5.4-1. For samples with lower concentrations expected, ultra clean procedures will be followed per EPA Method 1669.

B3.2 Sample Handling

See applicable SAP documents for details on sampling handling.

B3.3 Sample Delivery

The samples will be delivered to the analytical laboratory via external courier as described in applicable Sample and Analysis Plans for the activity being sampled.

B3.4 Sample Custody and Documentation

Each individual SAP details sample custody and documentation, including a sample of a chain of custody form. Please refer to each individual SAP for this information.

B3.5 Sample Collection, Transport, and Custody Documentation

A copy of all field forms to be utilized as part of the sampling tasks for this project, including the Field Sampling Form and Chain of Custody Form, are included as Appendices F and G of the SAP.

B4 Analytical Methods Requirements

B4.1 Analytical Methods

Pace Analytical will perform the laboratory analyses for the surface water and groundwater samples that will be collected at the Site. EPA-approved methods will be used in the analysis of the samples collected. Case narratives will be provided with each analytical data package and will discuss details of failures and/or exceptions in maintaining method performance, or other, requirements. Corrective action (e. g., re-analysis or re-calibration) may be required in incidents of unacceptable precision, recovery, instrument calibration, etc. The specific analytical parameters to be tested for this project are presented in Table A5.4-1. Furthermore, Section C1.3 outlines the procedures to follow when failures occur, identifies the person(s) responsible, and defines the appropriate documentation for the corrective action.

Field SOPs related to sample collection are found in the applicable SAP. Refer to the appropriate SAP for a list of and copies of each SOP.

Laboratory SOPs related to sample preparation, analysis, and reporting are provided as reference with this QAPP. The applicable SOPs are as follows:

Table B4-1: Applicable Laboratory Standard Operating Procedures

SOP No.	Revision	Date	Description	Regulatory Citation	Modifications
S-KS-M-006	9	12-26-12	Sample Preparation and Analysis for Mercury	EPA Method 245.1/7470A/7471A/7471B	Not clarified
S-KS-M-009	3	2-4-2013	Determination of Metals by ICPMS	SW-846/6020A/ EPA 200.8	Not clarified
S-KS-I-050	0	1-11-2013	Automated Alkalinity	2320B	Not clarified
S-KS-M-005	13	2-12-2013	Determination of Metals by Inductively Coupled Plasma-Atomic Emission Spectrometry	EPA 200.7 / 6010B	Not clarified
S-KS-I-043	8	6-29-2012	Determination of Inorganic Anions by Ion Chromatography	EPA 300.0, Rev. 2.1, August 1993 SW-846, Method 9056A	Not clarified
S-KS-I-047	1	6-29-2012	Sulfide by Methylene Blue Method	Standard Method 4520-S2-D	Not clarified
S-KS-I-039	11	10-17-2012	Nitrate-Nitrate by Automated Colorimetry	EPA 353.2	Not clarified
S-KS-I-022	11	12-14-2012	Total Suspended Solids	2540D	Not clarified
S-KS-I-036	8	2-4-2012	Total, Amenable, and Weak Acid Dissociable Cyanide	4500-CN E/G	Not clarified
S-KS-I-016	11	3-22-2013	Total Organic Carbon	Methods 5310C/9060A	Not clarified
S-MN-I-338	11	5-11-2012	Hardness by Calculation	Method 2340 B	Not clarified
S-GB-I-063	2	9-28-2012	The Determination of Total Organic Carbon Using the Teledyne Tekmar Fusion	SM 5310C, SW 846 9060A	Not clarified

SOP No.	Revision	Date	Description	Regulatory Citation	Modifications
S-MN-I-359	18	3-4-2013	Mercury in Liquid and Solid/Semi-Solid Waste	Method SW-846 7470A/7471/7471B and 245.1	Not clarified
S-MT-I-007	4	9-25-2012	Specific Conductivity and Salinity of Aqueous Samples	SM 2510B, SM2520B, ASA 10.3-3	Not clarified

B4.2 Analytical Turnaround Time

The standard turnaround time for Pace Analytical to complete the analysis and reporting requirements is four weeks (28 calendar days) from the time the laboratory receives the samples (see Rico Data Management Procedure and Timeline in Appendix A). In the event a shorter turnaround time is needed, the STL will coordinate with the laboratory project manager to ensure the request is processed accordingly.

B4.3 Independent Validation of the Analytical Methods

Data validation will be performed on final laboratory analytical data to ensure analytical data meet the DQOs defined in Section A7.2. Data validation is described in Section D1.3.

B5 Quality Control Requirements

General programmatic requirements for internal QC of laboratory data are established in the SOPs and the EPA-approved methods proposed for analyses. Laboratory-specific SOPs relative to this QAPP are provided separately with the Laboratory Quality Manual (LQM)

B5.1 Field Quality Control Checks

All field measurements and sampling are performed as specified in the SAP. In addition, measuring and test equipment used during environmental data collection activities will be subject to calibration requirements, as described in Section B6 of the QAPP.

B5.2 Analytical Laboratory Internal Quality Control

Internal QC procedures are designed to assure the consistency and continuity of data. Internal QC procedures are routinely carried out to assess the accuracy of the data generated, and are documented at the laboratory according to the laboratory QA Manual. Some of the internal QC procedures are as follows:

- Instrument performance checks
- Instrument calibration
- Documentation on the traceability of instrument standards, samples, and data
- Documentation on analytical methodology and QC methodology, including spiked samples, duplicate samples, and split sample use of reference blanks, and checking standards for method accuracy and precision
- Documentation on sample preservation and transport

A routine QA protocol is an essential part of the analytical process. See the Quality System Audits and Review of the Pace Analytical Laboratory Quality Manual (LQM) for a complete discussion of internal QA/QC procedures. The minimum requirements for each analytical run are discussed in the remainder of this section.

B5.2.1 Initial Calibration and Calibration Verification

Standard calibration curves are composed of a minimum of three to five standards, based upon the method. Typically a second source verification is performed using an Initial Calibration Verification (ICV) immediately after initial calibration. Requirements for initial and continuing calibration are specified in the applicable laboratory SOPs provided with the LQM and listed in Section B.4.1 above. Confirmation of acceptable calibration will be documented in the case narrative comments of the final laboratory reports.

B5.3 Analytical Quality Control Samples

Generally, quality control in the laboratory is guided by the laboratory-specific Quality Assurance Plan (QAP). Specifically, method blanks, laboratory control standards, matrix spikes, and laboratory duplicates are used, along with data review and documentation, to accomplish QA/QC objectives. In addition, the selected laboratory will use QA/QC procedures routinely used at the laboratory to maintain State of Colorado certification and will use analytical methods and method-specific QA/QC control as described in SW-846.

B5.3.1 Method Blank Analysis

The method blank is utilized to rule out contamination by reagent or method preparation. The blank is analyzed once with every batch of samples or type of matrix or 20 samples, whichever is more frequent.

B5.3.2 Matrix Spike and Duplicate Samples

The spike sample analysis provides information about the effect of the sample matrix on the analytical methodology. The percent recovery of the spike is calculated and compared to the criteria given in Table A7.1-1. The relative percent difference of the duplicate spikes or sample duplicates are calculated and compared to the precision criteria given in Table A7.1-1. The formulas for calculating accuracy and precision can be found in Section A7.2. At least one matrix spike sample, and once duplicate sample analysis or one MSD is performed for each batch of samples or every 20 samples, whichever is more frequent.

B5.3.3 Laboratory Control Samples

The LCS can be purchased from an outside vendor or prepared in the laboratory. The LCS is analyzed with every batch of samples, or after every 20 sample analyses, whichever is more frequent. Results must be within the acceptable range provided by the manufacturer or within control limits established by the laboratory SOPs as presented in Table A7.1-1. A discussion of control limits and formulas for calculating accuracy and precision were presented in Section A7.

B6 Instrument/Equipment Testing, Inspection, and Maintenance

Periodic preventative maintenance of equipment is required. Instrument manuals are kept on file for reference if equipment needs repair. Troubleshooting sections of manuals are often useful in assisting personnel in performing maintenance tasks. Appropriate and sufficient replacement parts or backup equipment are available so that sampling and monitoring are not substantially impeded or delayed.

B6.1 Field Instrument Preventative Maintenance

Depending on the media involved and the intended purpose, a wide variety of equipment is available for field sampling and field sampling support activities. Because of the reliance placed on such equipment, all sampling and sampling support equipment, whether electronic, mechanical, chemical, or otherwise, are maintained at a proper functional level, as dictated by the equipment manufacturers' recommendations.

Field sampling equipment is maintained to manufacturer's specifications and in operational condition. Equipment requiring routine maintenance includes water level probes, ultrasonic meters, pumps and tubing, bailers, turbidity meters, and multi-parameter water quality meters (used to measure pH, conductivity, oxidation-reduction potential [ORP], temperature and dissolved oxygen [DO]). Routine preventative maintenance, as well as per-use inspections and checkout, is conducted to assure proper operation of the various pieces of equipment. The objective of the preventative maintenance program for field sampling and field sampling support equipment is to avoid generating erroneous environmental measurements. Preventative maintenance also helps decrease the possibility of equipment failure and delays in scheduled activities.

Each piece of equipment used in activities affecting data quality is maintained according to specifications presented by the manufacturer. The STL has access to tools and spare parts to conduct routine maintenance. A backup instrument is always available during sampling events to account for deficiencies noted or equipment that may not function properly during use. If the equipment or instrument cannot be maintained to manufacturer's specifications or cannot be properly calibrated, it is returned to the manufacturer or other repair facility for proper maintenance and repair. Before being reinstated, the instrument is checked for compliance to project specifications. The maintenance records for field equipment are kept in the same notebook as the calibration data.

Support equipment includes safety devices, storage and transportation containers, wind indicators, cameras, and vehicles that may be required for completing an environmental monitoring or measurement task. Support equipment required to maintain the safety of the project work force is identified in the SSHASP.

B6.2 Laboratory Instrument Preventative Maintenance

For a complete discussion of preventive maintenance in the laboratory, see Section 6.0 of the Pace Analytical LQM.

B7 Instrument Calibration and Frequency

This section establishes the procedures for maintaining the accuracy of the field instruments and laboratory equipment used during the project. The responsibility for the calibration of laboratory equipment lies with the analyst. The STL is responsible for the calibration of field equipment.

B7.1 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures

Field equipment related to the collection of analytical data will include a thermometer, pH meter, electric conductivity meter, DO meter, and an ORP meter (or a multimeter capable of performing these functions), and decontamination equipment. The equipment will be inspected before each use. Equipment found in disrepair will be repaired according to manufacturer's guidance or replaced. Equipment decontamination will be performed as described in the SAP.

The water quality meter will be calibrated checked before each use, at a minimum, using standards (pH buffers) recommended by the manufacturer. Acceptable precision for instrument calibration is specified in the user's manual. Recalibration will be repeated until acceptable calibration is achieved or equipment will be replaced as necessary.

The conductivity meter will be calibrated before each use, at a minimum, using a standard solution recommended by the manufacturer. Proper calibration is considered to be achieved when within 10 percent of the standard concentration. If proper calibration is not achieved, recalibration will be repeated and equipment adjusted/replaced as necessary.

All individual meters and multi-meters will be field-checked for proper calibration before each use. According to the manufacturer's recommendation, daily full calibration is not required on these instruments and leads to an early breakdown in accuracy of the instrument, causing more frequent calibration cycles. If equipment is found to be out of calibration, an evaluation will be made and documented to determine the validity of previous measurements and/or corrective action will be implemented.

B7.2 Analytical Instrument Calibration, Maintenance, Testing, and Inspection Procedures

Laboratory equipment calibration requirements are specified in the applicable laboratory SOPs and LQM. Inspection and maintenance of laboratory equipment is performed according to the QAP. The laboratory's QAP and any applicable method-specific requirements will guide the QA/QC aspects related to laboratory supplies and consumables.

B7.3 Preparation of Standards for use with Laboratory Analytical Instruments

The laboratory calibration solutions and standards are further defined in the LQM, Section 6.0.

B8 Requirements for Supplies and Consumables

B8.1 Sampling Supply Inspection and Acceptance Procedures

Field supplies and consumables will include calibration fluids, decontamination fluids, water for equipment blanks, disposable gallon containers for initial sample collection, and plastic bags or sheets to keep decontaminated equipment clean before use. Materials that are visibly contaminated will not be used and will be replaced. If contaminated materials are identified, suppliers and/or handling procedures will be re-evaluated as appropriate. At a minimum, distilled water will be used for the preparation of equipment blanks. Purer grades of water may be selected for this purpose. If measurable concentrations of the metals of concern are reported in an equipment blank, the water will be tested, and replaced and the source re-evaluated, as appropriate. The analytical results of the water supply will then be evaluated, and any effect on the integrity of the surface water sample results assessed.

The supplies and consumables used in the field and in the laboratory will be inspected for usability and quality upon receipt. Prior to commencement of the sampling activities, the STL will confirm that all equipment, supplies, and consumables are functional and free of contamination. Materials not meeting acceptance criteria will be returned, replaced, or discarded, as appropriate.

In addition, the STL will track and store all equipment, supplies, and consumables appropriately. If needed, additional items will be replenished or replaced.

B9 Use of Existing Data (Non-Direct Measurements)

B9.1 Secondary Data Sources

Monitoring of surface water flow and quality at and in the vicinity of the Rico-Argentine Mine Site has occurred at varying locations and frequencies since 1978. A more regular program of surface water sampling and analysis was implemented in 1999, followed by adoption of a formal, regulatory SAP in 2003. A total of 21 sampling events were conducted from 2001 through 2006 by AR, ranging from a minimum of two to a maximum of eight events per year. The CDPHE conducted groundwater sampling and analysis in 2002 and 2003. AR conducted groundwater monitoring from 2004 to 2007. Data collected prior to December 2010 is referred to as "historical" data and is used as a secondary data source to help guide, develop, and evaluate current sampling operations at the Rico-Argentine Mine Site.

B9.2 Intended Use of Secondary Data

Currently, historical data can be accessed by internal project team members only. These data are accompanied by variable amounts of documentation describing field and laboratory methods used to collect and analyze the samples. Where such methods are documented, these data are being used to evaluate long-term analytical trends at specific sample locations. In addition, current data is being compared to these trends with consideration of different sampling and analysis methods.

At a future date, secondary data will be made available to all data users and will include qualifiers to inform the user of any uncertainty or anomalous values. Although the quality of the data is thought to be generally good, QA/QC procedures applied to the data are largely unknown, limiting the applicability of these data for regulatory purposes. Any historical data that is distributed will include necessary disclaimers as to their intended and/or recommended use.

B9.3 Acceptance Criteria

Data consistency will be verified using the current data to flag any anomalous historical results based on a range of expected values. This range will be defined based on statistical analyses performed by AECOM staff with the necessary expertise. Inconsistent data will be qualified appropriately and maintained in the database.

B9.4 Management of Secondary Data

The secondary data is stored in the project EQuIS database, which is described in more detail in Section B10.1. Future web-based mapping and database tools are planned to make data accessible for a broader project team.

B9.5 Validity and Applicability of Secondary Data

AECOM staff specializing in statistical analyses and geochemical analysis will be tasked with developing appropriate qualifiers. Users will determine the appropriateness of the data for their purposes based on the qualifiers provided. It is unknown whether the secondary data conforms to the QA/QC procedures defined within this document, and thus is not intended for use in the development of any permit or regulatory criteria.

B10 Data Management

Data management functions are essential in maintaining project data in a consistent and reliable repository so that it can be used to support project decisions and the DQOs. It is imperative that these functions are performed accurately and that accepted statistical techniques are employed to evaluate the quality and usability of the data. The following sections discuss data reduction, data validation, data reporting, and data management.

B10.1 Project Database

A relational database management system, EQuIS, will be used to store project data. The database will house water quality data (field parameters and laboratory results) as well as water level data and flow data. Both instantaneous and hourly flow data will be stored in the database.

In addition, the database will store location information for the sample locations. Horizontal coordinates will be expressed in Colorado State Plane coordinates, NAD83 datum, Zone 12, in units of U.S. Survey feet. Elevations, including monitoring well reference point elevations, will be measured relative to the NAVD88 vertical datum, in units of U.S. Survey feet.

Data collected under the current sampling program will be clearly separated from what is considered

"historic" project data (data collected prior to December 2010 under previous sampling programs). Additional types of data may be added to the project database in the future if deemed necessary. The database is managed by AECOM and is currently only available directly to AECOM staff (although exports from the database can be provided). Future plans include web-based access to the project database.

The project database will be protected to prevent unauthorized use and access using standard IT and database management protocols. Database permission levels will be established so that only authorized users will be able to view the contents of the database. Database modifications will only be made by authorized users.

B10.2 Data Life-Cycle

B10.2.1 Field Data

Field monitoring information from sampling activities will be transferred by AECI from field sampling forms to a spreadsheet in a format suitable for inclusion in the monthly report. Data entry will be checked for accuracy before the report is sent to AECOM. The AECOM Data Manager will transfer the data electronically from the spreadsheets to the EQuIS database. Data to be transferred in this manner includes field parameters, water levels for monitoring wells, and instantaneous flow rates. Data are reviewed as described in section D1.1.

Continuous depth data will be downloaded from the data loggers by AECI, processed into hourly flow data using the procedures outlined in the SAP, and reviewed for quality and consistency. After review, the hourly flow data and the raw depth data will be transmitted to AECOM in spreadsheet format. This transmittal will occur along with transmittal of the monthly report. AECOM will perform a technical review the flow data to determine if the results conform to the expected range of values and then upload the data to the EQuIS database.

B10.2.2 Laboratory Data

Laboratory analytical results will be uploaded directly from the EDDs provided by the laboratory. Electronic data transfer reduces the likelihood of transcription errors. The EDDs will be checked against the AECI monthly report, the official laboratory PDF report, and COCs as described in Section D1.3.1. Analytical data from sampling activities will be subjected to independent data validation by the DVM and the database updated as appropriate to include any qualifiers assigned during data validation. Additional data review of water quality will be conducted as described in Section D1.3.2.

B10.2.3 Retrieval and Transfer of Information

Tables of water quality results, field parameters, and flow rates will be produced using the database software to meet project needs. Data can be provided on computer disk and/or as printed reports. If applicable, data summary tables will be checked for accuracy against final hard-copy laboratory reports.

The monthly report will be prepared by AECI and reviewed by AECOM. The final copy of the report will be made available on the project SharePoint site in PDF format. Supplemental spreadsheets of water quality data, water levels, and flow data can be made available to EPA to allow for easier evaluation of data trends.

Group C: Assessment and Oversight

C1 Assessment and Response Actions

Planned and documented performance audits may be conducted to verify compliance with specific project QA/QC program requirements for both laboratory and field activities. These audits will consist, as appropriate, of an evaluation of QA/QC procedures, the effectiveness of the QA/QC implementation, and a review of project documentation. If problems are noted, the QAM or other authorized assessor can stop the work to take corrective measures. The results of all field and laboratory audits will be shared with all parties to enhance the quality of future work.

C1.1 Field Performance and System Audits

An audit of the field operations may be performed if requested by the QAM. The audit will only be performed if routine review of data (as described in Section B.10) indicates a reason for concern. The field operations audit involves a review of field activities by the QCM with assistance from the STL. Items to be examined will include, as appropriate, the availability and implementation of approved work procedures, sampling procedures, sampling documentation and specifications; calibration and operation of equipment; labeling, packaging, storage, and shipping of samples; performance documentation and checking; and nonconformance documentation. The field SOPs and manufacturer specifications include specific information regarding calibration of specific measuring devices, work procedures, sampling procedures, sample handling, and sample shipment.

The records of field operation will be reviewed to verify that field-related activities are performed in accordance with appropriate project procedures. Items reviewed will include, but will not be limited to, the calibration records of field equipment, field activity logs, data, sample collection and custody forms, and field log books.

C1.2 Laboratory Performance and System Audits

Audits may be conducted for laboratory operations to assess accuracy of measurement systems and determine effectiveness of QC procedures. The audit will only be performed if routine review of the laboratory data (as described in Section B.10) indicates a reason for concern. If required, the laboratory audit will be performed by the DVM with assistance by the LPM and the LQAM.

Laboratory audits will be conducted internally by the LQAM following the procedures outlined in Section 8.0 – Quality System Audits and Reviews of the Pace Analytical LQM. Follow-up audits may occur to verify implementation of required corrective actions.

Activities selected for audit will be evaluated against specified requirements and will include an objective evaluation of the methodology. Typical items reviewed during a laboratory audit include:

- Documentation of the QA Program
- Results of proficiency testing
- Consistency of test procedures with current methods
- Documentation of approval for all test procedure modification
- Proper storage and labeling of reference standards
- Glassware cleaning procedures
- Documentation of laboratory water purity
- Proper sample storage and COC
- Records of instrument maintenance
- Traceability and supervisor review of data and calculations
- Record retention systems
- Provisions for confidentiality of data

C1.3 Corrective Action

Corrective action will be undertaken when QC data fail to meet the prescribed limits or when the overall quality of the project is suspect. Corrective actions will be determined based on the nature and severity of the problem. Generally, repeat measurements and/or sample preparation will be required.

Corrective action is dictated by the type and extent of the nonconformance. Corrective action may be initiated and carried out by non-supervisory staff, but final approval and data review by management is necessary before reporting any information. All potentially affected data must be thoroughly reviewed for acceptance or rejection.

Nonconforming items and activities are those that do not meet the project requirements or approved work procedures. Nonconformances may be detected and identified by any of the following groups during the activities indicated:

- **Project Staff** – While conducting field activities and testing, completing audits, and verifying numerical analyses
- **Laboratory Staff** – While preparing for and conducting laboratory testing, calibrating equipment, and carrying out QC activities
- **QA/QC-Staff** – While performing audits

Each nonconformance will be documented by the person identifying or originating it. For this purpose, a variance log, testing procedure record, notice of equipment calibration failure, results of laboratory analysis control tests, post-audit report, internal memorandum, or letter will be used, as appropriate. Documentation will, as necessary, include the following:

- Name(s) of the individual(s) identifying and/or originating the nonconformance
- Description of the nonconformance
- Any required approval signatures
- Method(s) for correcting the nonconformance or description of the variance granted
- Schedule for completing corrective action

Documentation will be made available to project, laboratory, and/or QA management. Appropriate personnel will be notified by the management of any significant nonconformance detected by the project, laboratory, or QA staff. Implementation of corrective actions will be the responsibility of the QCM or LQAM. Any significant recurring nonconformance will be evaluated by project or laboratory personnel to determine its cause. Appropriate changes will then be instituted in project requirements and procedures to prevent future recurrence. When such an evaluation is performed, the results will be documented.

Any major problem identified in the field or laboratory will be brought to the attention of the project managers prior to corrective action being applied. All major problems and corrective actions will be documented in the appropriate project report.

C1.3.1 Field Activities

Corrective action to be taken as a result of nonconformance during field activities will be situation-dependent. If possible, action will be taken in the field to correct any nonconformance observed during field activities. If necessary and appropriate, corrective action may consist of re-sampling. If implementation of corrective action in the field is not possible, the nonconformance, and its potential impact on data quality, will be discussed in the groundwater monitoring report. All field corrective actions will be recorded in the field log book.

C1.3.2 Analytical Laboratory

Corrective action procedures within the laboratory are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike

and calibration mixes, instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the laboratory technical personnel or group leader, manager, and/or QA department for further investigation. Once the problem is resolved, full documentation of the corrective action procedure is filed with the LQAM by means of a Nonconformance Memo or similar form. Corrective action documentation is routinely reviewed by the LQAM. Nonconformances and corrective actions will be discussed in the report narrative.

The laboratory will be contacted regarding any deviations from the QAPP, and will be asked to provide written justification for deviations. In some instances, the laboratory will be asked to reanalyze the sample(s) in question. Additional details on laboratory corrective actions are found in Section 9.0 of the LQM

C2 Reports to Management

If the QAM or QCM deems it necessary to conduct a field or laboratory audit, the results of this audit, corrective actions, and follow up will be reported to management. The report will explain the reason for the audit; list who participated in the audit; describe the processes that were inspected and the findings; and explain the corrective actions to be taken and the findings of any follow-up inspections to ensure the recommended corrective actions were implemented. The report will be submitted, as appropriate, to the EPA On-Scene Coordinator, the AR PM, the AECI PM, and the AECOM PM.

Group D: Data Validation and Usability

D1 Data Review, Verification, and Validation

The data collection and management process is defined by the Rico Data Management Procedure and Timeline provided as Appendix A to this plan. This procedure and timeline defines the steps followed from sample collection to final submittal of the data. It further defines roles, responsibilities, and schedule for each step of the process.

As discussed in Section B9, any data used from non-direct measurement sources such as computer databases, programs, literature files, and historical databases will be reviewed for representativeness, bias, and precision. Any limitations on the use of the data resulting from uncertainty in its quality will be evaluated. The rationale for the original collection of the data and its relevance to the project will also be addressed. Any historic data incorporated into the EQuIS database will be clearly flagged as being "historic" so it is clear that the data was not necessarily submitted to the same QA/QC reviews as the data collected for the current monitoring program.

Data review, verification, and validation are used to ensure quality from sample planning, sampling, sample shipping, analytical procedures, data review by the laboratory, and consultant independent data validation, through to the final report.

D1.1 Field Data (AECI)

Field data includes water quality parameters measured in the field, water levels and flow rates, and data collected from pressure transducers. The QCM is responsible for reviewing all field data and for verification of the data obtained from field measurements and calculations used to process data. The data verification will include ensuring that correct codes, units, sample locations, blind duplicate locations, analytical parameters, dates, and times, as well as other pertinent information, are included on the sampling forms, field log books, and custody forms. The QCM will also ensure that field instruments are properly calibrated are maintained, and that all required field QC samples have been analyzed and are within acceptable criteria. Any required corrections to field data will be made by placing a single line through the entry, and initialing and dating the correction. Variations in data that cannot be explained will be assigned a lower level of validity and will be used for limited purposes. The QCM will summarize the data obtained from field measurements and include this information in the sampling field methods portion of the monthly report.

Data will be entered on hard-copy sample forms in the field and transcribed to spreadsheets in the office. The QCM will ensure that this data entry is thoroughly reviewed to check for data-entry errors. The QCM will also ensure that data-reduction calculations performed on pressure transducer data are performed using proper methods and checked for accuracy.

D1.2 Laboratory Data (Pace)

D1.2.1 Data Reduction

For most analyses, laboratory data reduction involves comparing the response of samples to that of standards used to create a standard reference curve. Samples and sample extracts are diluted so that the responses fall within that of the standard curve. The sample response is then multiplied by the appropriate dilution factors to obtain the final result. Results from analyses that do not utilize a standard calibration curve are calculated using the formula given in the method, taking the number of significant figures into account. The equations for data reduction are given in the laboratory SOPs. The laboratories make use of direct upload to transfer reduced data to the LIMS where reports are generated. This significantly reduces the chances for error from manual data entry.

D1.2.2 Data Verification by the Laboratory

The laboratory project manager and the individual laboratory group leaders will be responsible for verifying data prior to laboratory reporting of results. A 100 percent data review of raw analytical data is performed by a peer or supervisor prior to release to the LPM. Included in this laboratory data verification is an assessment of the acceptability of the data with respect to the following:

- Adherence to required analytical procedures
- Correctness of numerical inputs when computer programs are used (random check)
- Numerical correctness of calculations and formulas (random check)
- Correct interpretation of chromatograms, mass spectra, etc.
- Acceptability of QC data
- Documentation that instruments were operating according to method specifications (calibrations, performance checks, etc.)
- Documentation of dilution factors, standard concentrations, etc.

D1.3 Data Validation and Technical Review (AECOM)

D1.3.1 Data Validation

A final independent validation of all laboratory data will be provided by the DVM. This data validation provides an impartial evaluation of the laboratory results by an individual who was not involved with the sample collection or analysis. The data validation process assures technical data quality and method compliance; provides precision, accuracy, and completeness assessments; verifies that adequate analytical documentation was performed and reported; determines whether the analytical data are usable; and helps the data user to determine whether project quality objectives were met.

Data validation will be done on the final reports submitted by the analytical laboratory according to quality directives defined in the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review* (NFGs) (EPA, 2010), as applied to the reported methodology and QC criteria defined in this QAPP. The data validation reports and checklists will include assessments of data precision, accuracy, completeness, and method compliance according to the submitted data. Sample results, case narratives, and analytical QC summaries will be reviewed at a frequency of 100 percent. All sample and QC results will be compared to the EDDs at a 100 percent frequency and updated in the project database.

The data validation reports will address the following data measurements as applicable to the reported methodology:

- Overall precision, accuracy, method compliance, and completeness
- Sample custody and integrity
- Case narrative comments
- MDLs, PQLs, and sample quantitation
- Holding time compliance
- Method blanks
- Field-originating blanks
- LCS results
- MS results
- Laboratory duplicate or spiked duplicate results
- Field duplicate results (calculated RPDs)

A summary table of any qualified data will be included in the data validation report, along with qualifier definitions. The data will be qualified as acceptable, estimated, or rejected based upon the requirements given in the validation guidance. An example data validation report is provided in Appendix C.

A list of data validation qualifiers applicable to the proposed methods is given below.

J estimated concentration
J+ estimated concentration, high bias indicated
J- estimated concentration, low bias indicated
R rejected due to severe QA/QC noncompliance
U evaluated to be undetected at the reporting limit/concentration, due to evidence of contamination
UJ undetected, reporting limit is estimated

Any rejected data or data that is identified as unacceptable for its intended purpose will either be eliminated from the decision-making process or qualified for limited use (e.g., approximation purposes).

D1.3.2 Additional Data Review

As described in Section 10.2.2, above, additional data quality reviews will be performed in addition to the independent data validation described above. Reviews will be performed to ensure that the laboratory reports are complete and match the EDDs, that the water quality data are within expected ranges and ratios relative to other parameters, and the flow data calculations and data reductions are performed correctly and are consistent with overall trends for the site.

- The AECOM DVM will compare the EDDs to the official laboratory report to check for completeness (all requested samples and analytes reported) and consistency (reported values on EDD match values in laboratory report).
- The AECOM Water Quality Reviewer will review the water quality data to assess whether data are comparable to the expected ranges and in expected ratios relative to other related parameters.
- The AECOM Flow Data QC Reviewer will check the accuracy of the calculations necessary to transform hourly data from data loggers into flow rates and review overall trends of the flow data.

D2 Reconciliation of the Data with User Requirements

Limitations on the data will be reported to the data users in the form of data validation qualifiers for laboratory analytical data. The appropriate data validation qualifiers (as described above) will be stored in the EQuIS database along with the laboratory data. Any qualifiers will be reported along with the laboratory analytical data as presented in the monthly report and the spreadsheets generated from the database. Any other limitations on the data identified through the other quality checks described above will be documented in narrative form in the monthly report.

The results of the QA/QC methods implemented during the project will be evaluated and summarized. An assessment of overall data usability will be prepared. The project will be considered successful if the data generated under this QAPP is accurate, precise, comparable, representative, and complete, and sufficient to meet the DQOs.

References

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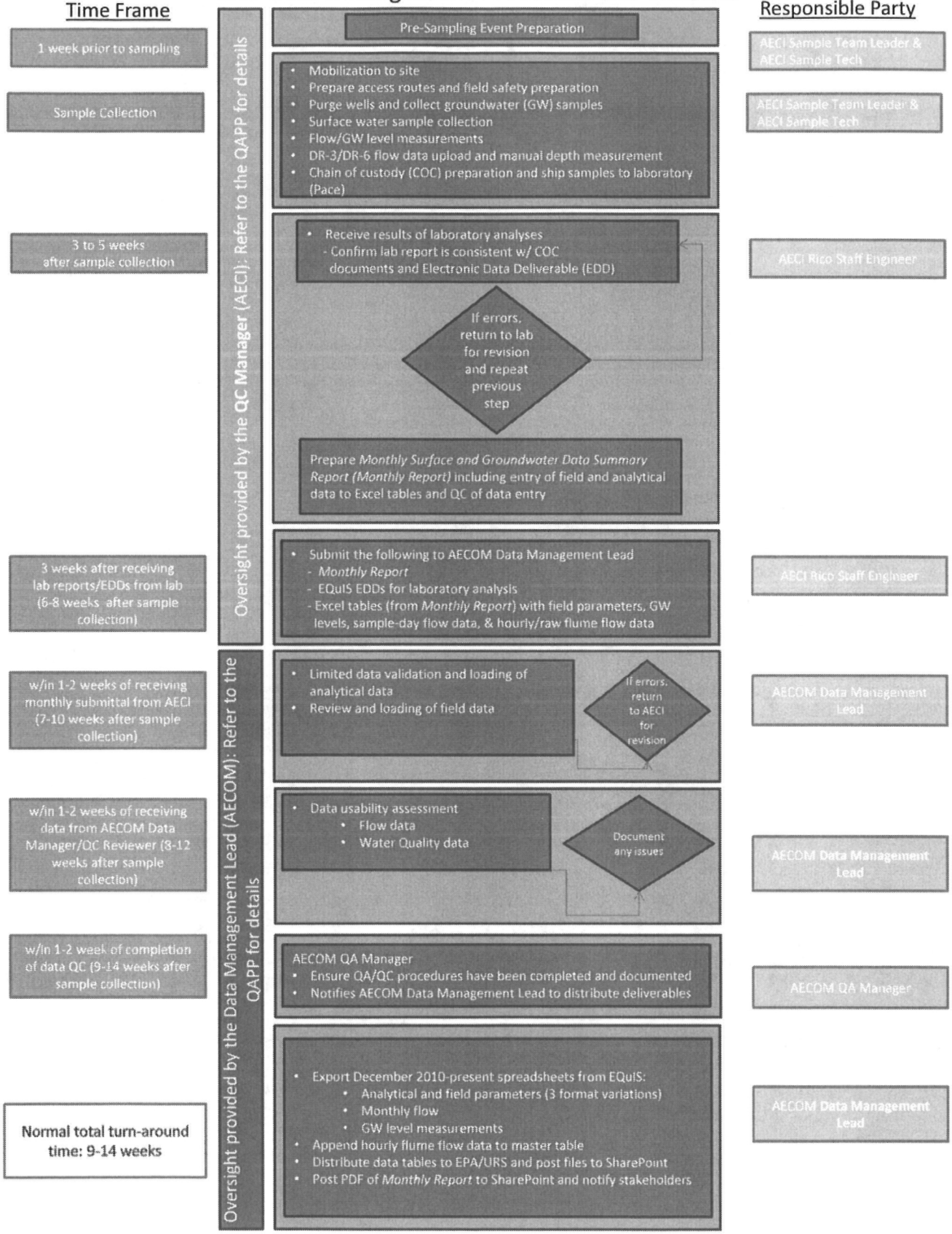
Appendix A

Rico Data Management Procedure and Timeline

Rico Data Management Procedure and Timeline



Appendix B
Training Certification Form

Training Record Date:

Project:
Topics:

Name (Print)	Signature	Company
Trainers		

Appendix C
Example of Data Validation Report

Submitted to:

Submitted by:
AECOM

AECOM Environment

Date

Title

Prepared By

Overview

List of Submitted Deliverables

Data Validation Qualifiers Assigned During this Review

Overall Data Assessment

Table of Samples Analyzed
Title

Matrix	Sample ID	Sample Date	Sample Time	Lab SDG	Lab Sample ID

ANALYTICAL LIMITED DATA VALIDATION CHECKLIST

Project Name:			Laboratory:				
Project Reference:			Sample Matrix:				
AECOM Project No.:			Sample Start Date:				
Validator/Date Validated:			Sample End Date:				
Samples Analyzed:							
Parameters Reviewed:							
Laboratory Project ID/Sample Delivery Group (SDG):							
PRECISION, ACCURACY, METHOD COMPLIANCE, AND COMPLETENESS ASSESSMENT							
Precision:		Acceptable		Unacceptable		Initials	
Comments:							
Accuracy:		Acceptable		Unacceptable		Initials	
Comments:							
Method Compliance:		Acceptable		Unacceptable		Initials	
Comments:							
Completeness:		Acceptable		Unacceptable		Initials	
Comments:							
VALIDATION CRITERIA CHECK							
Data validation qualifiers assigned during this review:							
1. Did the laboratory identify any non-conformances related to the analytical results?		Yes		No		Initials	
Comments:							

ANALYTICAL LIMITED DATA VALIDATION CHECKLIST

2. Were sample Chain-of-Custody forms complete?		Yes		No		Initials
Comments:						
3. Were all the analyses requested for the samples on the COCs completed by the laboratory?		Yes		No		Initials
Comments:						
4. Were samples received in good condition and at the appropriate temperature?		Yes		No		Initials
Comments:						
5. Were the reported analytical methods in compliance with WP/QAPP, permit, or COC?		Yes		No		Initials
Comments:						
6. Were detection limits in accordance with WP/QAPP, permit, or method?		Yes		No		Initials
Comments:						
7. Do the laboratory reports include only those constituents requested to be reported for a specific analytical method?		Yes		No		Initials
Comments:						
8. Were sample holding times met?		Yes		No		Initials
Comments:						

ANALYTICAL LIMITED DATA VALIDATION CHECKLIST

9. Were correct concentration units reported?		Yes		No		Initials
Comments:						
10. Were the reporting requirements for flagged data met?		Yes		No		Initials
Comments:						
11. Were laboratory blank samples free of target analyte contamination?		Yes		No		Initials
Comments:						
12. Were trip blank, field blank, and/or equipment rinse blank samples free of target analyte contamination?		Yes		No		Initials
Comments:						
13. Were instrument calibrations within method or data validation control limits?		Yes		No		Initials
Comments:						
14. Were surrogate recoveries within control limits?		Yes		No		Initials
Comments:						
15. Were laboratory control sample recoveries within control limits?		Yes		No		Initials
Comments:						
16. Were matrix spike recoveries within control limits?		Yes		No		Initials
Comments:						

ANALYTICAL LIMITED DATA VALIDATION CHECKLIST

17. Were duplicate RPDs and/or serial dilution %Ds within control limits?		Yes		No		Initials
Comments:						
18. Were organic system performance criteria met?		Yes		No		Initials
Comments:						
19. Were internal standards within method criteria for GC/MS sample analyses?		Yes		No		Initials
Comments:						
20. Were inorganic system performance criteria met?		Yes		No		Initials
Comments:						
21. Were blind field duplicates collected? If so, discuss the precision (RPD) of the results.		Yes		No		Initials

Duplicate Sample No.		Primary Sample No.	

Comments:

Method	Units	Analyte	Sample	Sample	RPD	Qualifier

ANALYTICAL LIMITED DATA VALIDATION CHECKLIST

22. Were qualitative criteria for organic target analyte identification met?		Yes		No	SM	Initials
Comments:						
23. Were 100% of the EDD concentrations and reporting limits compared to the hardcopy data reports?		Yes		No		Initials
Comments:						
24. General Comments:						

Table of Qualified Analytical Results
Title

Sample ID	Lab ID	Method	Diln	QC Batch	Analyte	Concentration	Qualifier	Reason Code

Reason Codes: